A Societal Impacts Climatology For The Las Vegas CWA Part I – Costliest Weather Disasters

Chris Stachelski
NWS Las Vegas

With the increasing emphasis in the National Weather Service on societal impacts, it was decided to compile a climatology – essentially a list – of the costliest weather events in the current Las Vegas, NV County Warning Area (CWA). This climatology was based upon the current CWA as of 2011 which includes all of Clark, Lincoln and Esmeralda Counties in Nevada, the central and southern portions of Nye County, Nevada, all of Mohave County, Arizona, all of Inyo County, California and the most of the desert portions of San Bernardino County, California.

Events were largely obtained from *Storm Data and Unusual Weather Phenomena* from both the web database available from NOAA's National Centers for Environmental Information (NCEI) and from paper copies for years and months that were not in the web database back to 1959. Prior to that year, storm events were published by the National Weather Service (then U.S. Weather Bureau) in a section of *Climatological Data National Summary*. This publication was analyzed back to 1950 to compile events from the 'Storm Data' section in it. Prior to 1950, events were published in *Monthly Weather Review* which was published then by the U.S. Weather Bureau. Online versions of hard copies of *Monthly Weather Review* were obtained from the American Meteorological Society website and date back to 1872.

While *Storm Data* is the official publication of the National Weather Service which lists damage information about storms and the costs associated with then, this publication has been shown in several studies conducted by other authors over the years not to be a full proof guide to damaging events in an area. Prior to the mid 1990s data from the counties that comprises the current NWS Las Vegas CWA were entered into Storm Data by National Weather Service forecast offices in Reno, Phoenix and Los Angeles. For unknown reasons, a number of events that occurred in the Las Vegas area that have caused damage were not documented at all in *Storm Data* prior to the mid 1990s. These events were obtained from news articles published in the *Las Vegas Review-Journal* and the *Las Vegas Sun* on microfilm at the University of Nevada, Las Vegas. Pictorial and written evidence in these articles describes damage totals that were used to supplement the official reports obtained from *Storm Data*. Additional sources for damage were taken from a study done by Darryl Randerson of Air Resources Laboratory (ARL) on the July 1975 Caesars Palace Flash Flood. In that article, Randerson listed a table that showed a list of damage costs associated with flash floods in the Las Vegas Valley. Another source used for identifying costs associated with damaging weather events prior to 1950 were various editions of the *Climatological Data* publication which is published monthly for Nevada, Arizona and California and listed events in a narrative section contained in each respective state's section. It should be noted that due to less detailed records prior to 1950, it is possible some events occurred that were not captured in this study.

After a list of events was compiled, it was decided to use the minimum threshold of $1 million to determine the costliest events across the NWS Las Vegas CWA. Events were counted as they appeared in *Storm Data*. Thus, one storm may have caused two separate 'events' in the list presented here in some cases. If possible, events were merged together to create a more accurate damage total if they occurred from one storm or a series of storms that resulted on consecutive days from the same meteorological set-up (i.e., a slow moving upper level low). This may create some confusion with the list, however, events in older editions of *Storm Data* largely lumped events together rather than breaking apart specific damages from flooding and thunderstorm wind or gave a total and listed the damage by what the primary cause was.

Costs for events were taken from the value listed in *Storm Data* or the respective National Weather Service publication when clearly listed. Starting largely in the mid 1990s, events in *Storm Data* are listed with an actual dollar estimate of the damages associated with them. Prior to this time period, and even in many instances in the mid 1990s, damage amounts were listed as a category that corresponded to a range. In some cases the range was listed as well as an actual dollar amount. If an actual dollar amount was listed, it was used. If an actual dollar amount was not used, then a best estimate from within the range was taken based on the description within *Storm Data*. In most instances, this resulted in a value from the range taken on the higher side of the range to offset the bias of underestimating the actual cost of storm damages.

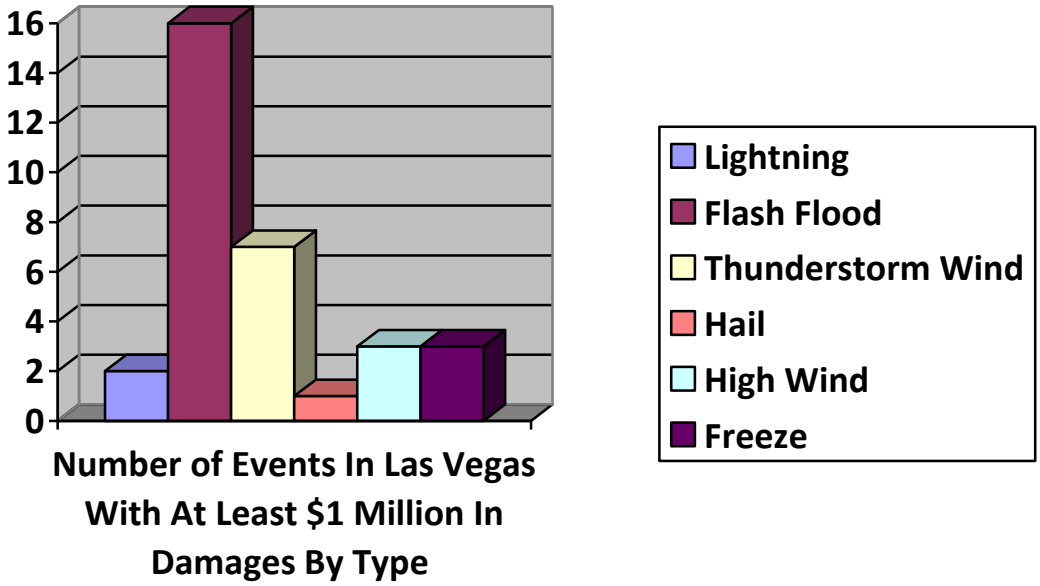
Two lists were then compiled – one for events strictly within the Las Vegas Valley – and another for the entire Las Vegas CWA. This list, given the limitations of the data it was compiled from, is a best effort to compile the costliest events ever in the Las Vegas CWA and Las Vegas Valley. Amounts listed are the value from the year they occurred in. No attempt was made to adjust for rises in the cost of living since the disaster occurred. This list is valid through December 2015.

Las Vegas

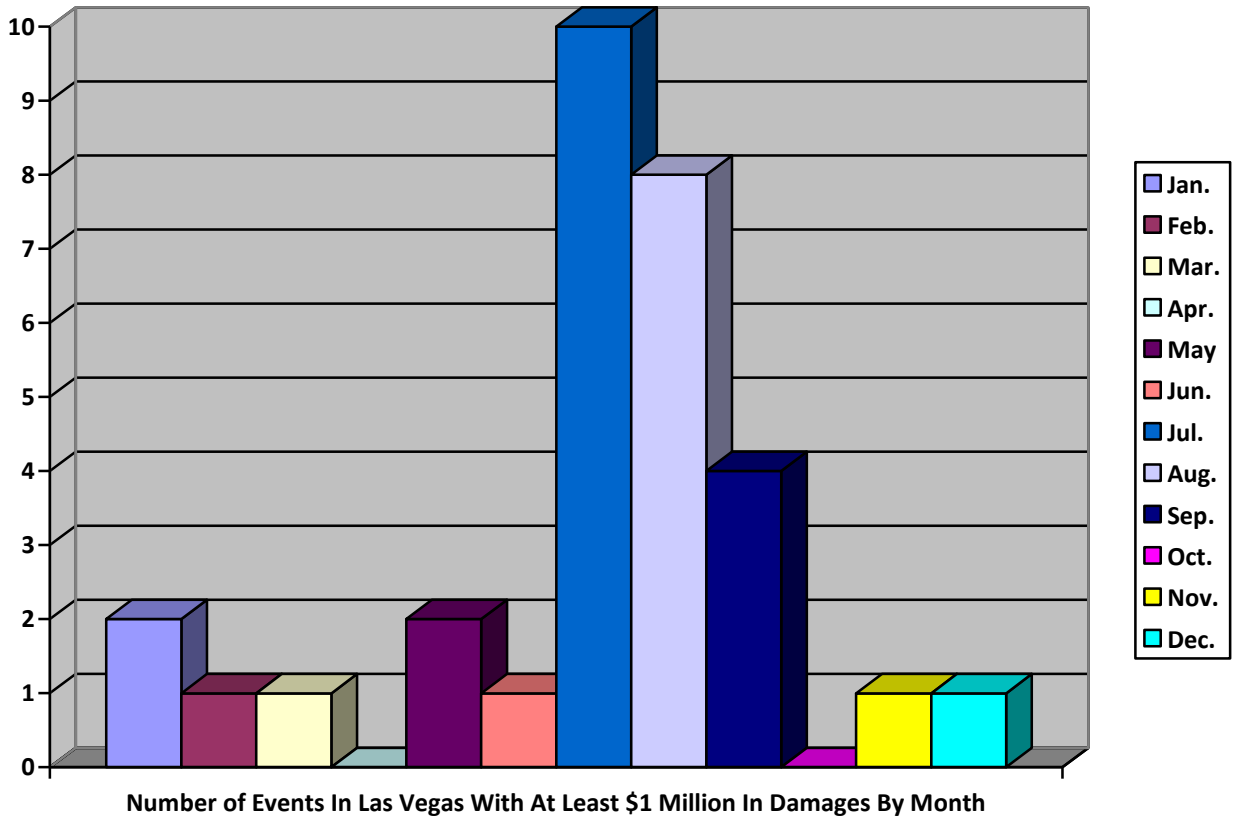
This an entire list of events in the Las Vegas Valley with damage totals of $1 million or more:

Rank	Date	Event Type	Event	Damage Total
1	July 15, 2012	Hail	Summerlin/NW Las Vegas/ North Las Vegas Hail Storm	$50 million
1	July 18, 1994	Thunderstorm Wind	Hilton Sign Thunderstorm	$50 million
3	July 8, 1999	Flash Flood	Widespread Las Vegas Flash Flood	$25 million
4	September 11, 2012	Flash Flood	Las Vegas Valley Flash Flood mainly East Side	$20 million
5	August 8, 1989	Thunderstorm Wind	McCarran Microburst	$14 million
6	July 20, 1998	Flash Flood and Thunderstorm	Las Vegas	$11 million
7	July 16, 1990	Flash Flood	Las Vegas	$8.7 million
8	August 27, 2007	Flash Flood and Lightning	Remnants of Dean	$6 million ($5 million from flooding, $1 million from lightning)
9	January 12-16, 2013	Freeze	Las Vegas	$5 million
9	August 22, 2012	Flash Flood	South Las Vegas/Henderson Flash Flood	$5 million
11	July 3-4, 1975	Flash Flood	Caesars Palace Flood	$4.5 million
12	August 10, 1997	Flash Flood	Henderson	$4 million
12	September 10, 1984	Flash Flood	Las Vegas	$4 million
	August 25, 2013	Flash Flood	NW Las Vegas	$3 million
14	June 13, 1955	Flash Flood and Thunderstorm	Las Vegas	$2.7 million
15	July 19, 2013	Thunderstorm	Las Vegas	$2.5 million
16	August 19, 2003	Flash Flood	NW Las Vegas	$2 million
16	August 10, 1983	Flash Flood	Las Vegas	$2 million
16	September 16, 1961	Thunderstorm Wind	Las Vegas	$2 million
16	February 2-4, 2011	Freeze	Las Vegas	$2 million
20	January 1-3, 2011	Freeze	Las Vegas	$1.5 million
20	July 9, 1998	Lightning	Henderson	$1.5 million
22	July 19, 1998	Thunderstorm Winds	Las Vegas	$1.3 million
23	December 5-6, 1966	Heavy Rain and Flash Flooding	Las Vegas	Over $1 million
24	July 3, 2011	Thunderstorm	Las Vegas	$1 million

		Winds		
24	March 18, 2010	High Winds	Las Vegas – Cloud Nine Balloon	$1 million
24	May 30, 1991	High Winds	Las Vegas	$1 million
24	August 18, 1983	Flash Flood	Las Vegas	$1 million
24	November 12, 1973	High Winds	Las Vegas	$1 million
24	May 20, 1966	Thunderstorm Wind	Las Vegas	$1 million
24	September 4, 1963	Flash Flood	Las Vegas	$1 million



The graph above shows the number of events by the type of weather of the primary cause of damage. The number of events where flash flooding was the dominant cause of damage was 16 and this tied the combined total of 16 from the other five event types. The event of August 27, 2007 was counted as two events here – one flooding and one lightning – since it had separate entries in *Storm Data* with damage totals of at least $1 million from both flash flooding and lightning.



Number of Events In Las Vegas With At Least $1 Million In Damages By Month

The graph above shows the number of events by month in Las Vegas with an event that had damages that totaled at least $1 million. Events were counted as one event on this graph as they were ranked on the list of events. July was the leading month with 10 events followed by August which had 8 events. The warm season months by far had the greatest number of events, which correlates well to the number of events that had damages resulting from flash flooding. Although a few of the flash flood events did occur in the cold season, most the result of thunderstorms associated with warm season convection. Two months had no events at all with damages exceeding $1 million which are in the transition seasons.

Entire National Weather Service Las Vegas CWA Including Las Vegas

This an entire list of events in the NWS Las Vegas CWA including the Las Vegas Valley with damage totals of $1 million or more:

Rank	Date	Event Type	Counties	Event	Damage Total
1	July 15, 2012	Hail	Clark	Summerlin/NW Las Vegas/ North Las Vegas Hail Storm	$50 million
1	July 18, 1994	Thunderstorm Wind	Clark	Hilton Sign Thunderstorm	$50 million
3	August 25, 2013	Flash Flood	San Bernardino	Fort Irwin	$40 million
4	October 18, 2015	Flash Flood	Inyo	Scotty's Castle Flash Flood	$25 million
4	July 8, 1999	Flash Flood	Clark	Widespread Las Vegas Flash Flood	$25 million
6	September 11, 2012	Flash Flood	Clark	Las Vegas Valley Flash Flood - mainly East Side	$20 million
6	January 11-12, 2005	River Flood	Clark, Lincoln	Virgin and Muddy Rivers Flooding	$20 million
6	August 15, 2004	Flash Flood	Inyo	Death Valley Flash Flood	$20 million
9	August 8, 1989	Thunderstorm Wind	Clark	McCarran Microburst	$14 million
10	December 17-23, 2010	River Flood, Flash Flood, Heavy Rain, Heavy Snow and Wind	San Bernardino, Mohave, Clark, Lincoln, Inyo, Nye and Esmeralda Counties	"Permalow" Winter Storm	$13.5 million ($10 million from flooding, $2.5 million from Flash Floods, $0.5 million from heavy snow, $40,000 from heavy rain and $15,000 from wind)
11	July 20, 1998	Flash Flood and Thunderstorm	Clark	Las Vegas	$11 million
12	August 10, 1981	Flash Flood	Clark	Moapa Valley Flash Flood	Over $10 million
13	July 12, 2008	Landslide	Inyo	Independence Landslide	$10 million
13	September 25-26, 1982	Flash Flood/Dam Failure	Inyo	Bishop Creek Flash Flood From North Fork Dam Failure	$10 million
15	July 16, 1990	Flash Flood	Clark	Las Vegas	$8.7 million
16	August 10, 1997	Flash Flood	Clark	Henderson and Boulder City Flash Flood	$8.5 million
17	January 12 -16, 2013	Freeze	Clark, Nye, Mohave and	Freeze in desert elevations below 3500 feet	$6.17 million

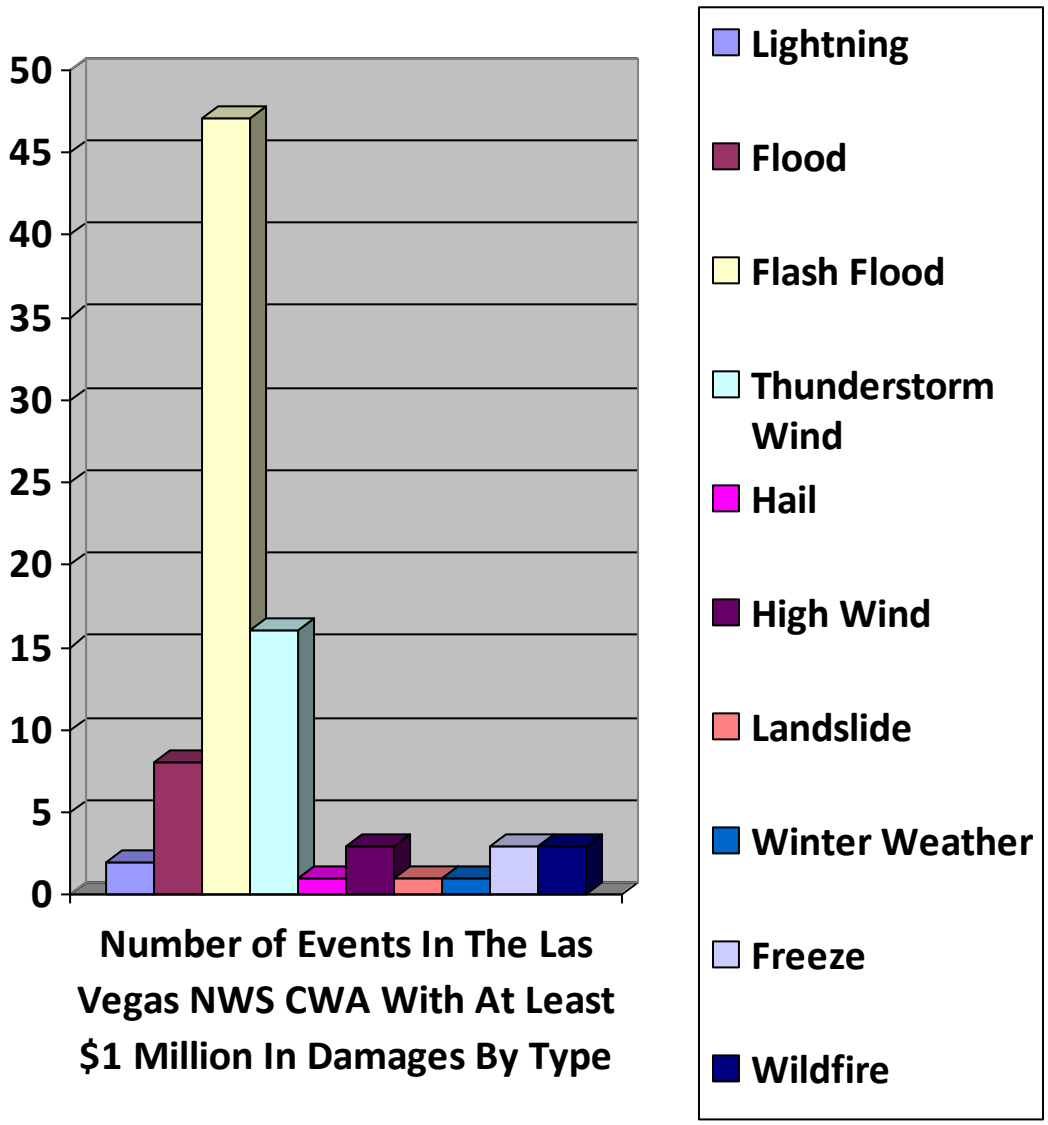
			San Bernardino		
18	September 8, 2014	Flash Flood	Clark	Moapa Norbert remnants Thunderstorm	$6 million
18	August 27, 2007	Flash Flood and Lightning	Clark	Remnants of Dean	$6 million ($5 million from flooding, $1 million from lightning)
20	July 20-29, 1984	Flash Flood	Clark	Various Flash Floods In Clark County	Over $5 million
21	August 22, 2012	Flash Flood	Clark	South Las Vegas/Henderson Flash Flood	$5 million
21	July 13, 2012	Flash Flood	Mohave	Lake Havasu City	$5 million
21	September 6, 1981	Flash Flood	Mohave	Topock, Yucca and Lake Havasu City	$5 million
21	September 14-15, 1974	Flash Flood	Clark	El Dorado Canyon Flash Flood	$5 million
21	February 23-26, 1969	Flood and Winter Weather	Clark and Nye	Winter Storms	$5 million
26	March 18-20, 2011	Wildfire	Inyo	Center Fire Big Pine Area	$4.5 million
26	July 3-4, 1975	Flash Flood	Clark	Caesars Palace Flood	$4.5 million
28	September 10, 1984	Flash Flood	Clark	Las Vegas	$4 million
28	January 1949	Winter Weather	Lincoln, Clark, Nye, and Esmeralda	3 winter storms killed a large number of sheep and cows	$4 million
30	January 18-22, 2010	Flood, Flash Flood, Thunderstorm, Heavy Rain and Winter Weather	Clark, Esmeralda, Mohave and San Bernardino	“Pacific Pounding” – Series of 4 El Niño Winter Storms	$3.4 million ($2.25 million Flood, $1 million Flash Flood, $200,000 Thunderstorm Wind, $125,000 Winter Weather and $15,000 Heavy Rain)
31	October 5, 2015	Flash Flood	San Bernardino	Fort Irwin	$3 million
31	September 8, 2014	Flood	Clark	Moapa River Valley Flood From Norbert remnants	$3 million
31	August 25, 2013	Flash Flood	Clark	Mt. Charleston/NW Las Vegas	$3 million
31	September 24, 1976	Flash Flood	Mohave	Bullhead City Flash Flood	$3 million

31	September 10-11, 1976	Flash Flood	Mohave	Bullhead City – Tropical Storm Kathleen	$3 million
36	September 3, 1997	Flash Flood	Nye	Pahrump Flash Flood	$2.7 million
36	June 13, 1955	Flash Flood and Thunderstorm	Clark	Las Vegas	$2.7 million
38	July 1, 2010	Wildfire	Clark	Moapa Wildfire	$2.5 million
38	July 19, 2013	Thunderstorm Wind and Flash Flood	Clark	Las Vegas	$2.5 million
38	August 12, 1982	Flash Flood	Mohave	Lake Havasu City Flash Flood	$2.5 million
38	August 2, 1982	Flash Flood	Mohave	Colorado City Flash Flood	$2.5 million
42	February 2-4, 2011	Freeze	Clark	Las Vegas	$2 million
42	August 25, 2008	Thunderstorm Wind	Mohave	Mohave Valley	$2 million
42	August 1, 2007	Flash Flood	Mohave	Kingman	$2 million
42	July 11, 1984	Thunderstorm Winds	Clark	Callville Bay	$2 million
42	August 19, 2003	Flash Flood	Clark	NW Las Vegas	$2 million
42	August 10, 1983	Flash Flood	Clark	Las Vegas	$2 million
42	September 16, 1961	Thunderstorm Winds	Clark	Las Vegas	$2 million
42	January 1, 1910	Flood	Lincoln	Caliente-Meadow Valley Wash New Years' Day Flood	$2 million
50	July 16, 1974	Flash Flood and Thunderstorm	Mohave	Lake Havasu City	$1.7 million
51	March 11-12, 1995	Flood	Mohave	Littlefield – Virgin River Flood	$1.6 million
51	August 20, 1973	Thunderstorm Wind	Clark	Lake Mead	$1.6 million
53	August 25, 2013	Flash Flood	San Bernardino	Needles	$1.5 million
53	February 2-4, 2011	Freeze	Clark	Las Vegas	$1.5 million
53	January 1-3, 2011	Freeze	Clark	Las Vegas	$1.5 million
53	July 9, 1998	Lightning	Clark	Henderson	$1.5 million
53	March 1-5, 1978	Flash Flooding	Mohave	Heavy Rain Event	$1.5 million
58	July 19, 1998	Thunderstorm Winds	Clark	Las Vegas	$1.3 million
59	December 5-6, 1966	Heavy Rain and Flash Flooding	Clark	Las Vegas	Over $1 million

60	September 14, 2015	Thunderstorm Wind	San Bernardino	Bannock – Railcars Blown Over	$1.2 million
61	July 24, 1976	Thunderstorm Winds and Flash Flood	Mohave	Kingman	$1.1 million ($1 million Thunderstorm, $85,000 Flash Flood)
62	August 12, 2014	Thunderstorm Wind	San Bernardino	Needles	$1 million
62	July 28, 2014	Flash Flood	Clark	Mt Charleston/Rainbow Canyon	$1 million
62	September 1, 2013	Flash Flood	Clark	Mt. Charleston/Rainbow Canyon	$1 million
62	August 30, 2013	Flash Flood	Clark	Mt. Charleston	$1 million
62	July 1-September 17, 2013	Wildfire	Clark	Mt. Charleston/Carpenter 1 Fire	$1 million
62	July 3, 2011	Thunderstorm Winds	Clark	Las Vegas	$1 million
62	October 4, 2010	Flash Flood	Clark	Callville Bay Marina	$1 million
62	March 18, 2010	High Winds	Clark	Las Vegas – Cloud Nine Balloon	$1 million
62	August 16, 2000	Thunderstorm Winds	Mohave	Lake Havasu City	$1 million
62	May 30, 1991	High Winds	Clark	Las Vegas	$1 million
62	September 5, 1990	Flash Flood	San Bernardino	Morongo Basin	$1 million
62	August 10, 1989	Flash Flood and Debris Flow	Inyo County	Olancha Creek	$1 million
62	August 25, 1988	Thunderstorm Wind	San Bernardino	Baker	$1 million
62	August 18, 1983	Flash Flood	Clark	Las Vegas	$1 million
62	August 7, 1983	Thunderstorm Wind	Mohave	Kingman	$1 million
62	June 20-July 31 of 1983	Flood	Mohave	Controlled river flooding on Colorado River	$1 million
62	August 16-17, 1977	Flash Flood	Mohave	Bullhead City – Tropical Storm Doreen	$1 million
62	November 12, 1973	High Winds	Clark	Las Vegas	$1 million
62	May 20, 1966	Thunderstorm Wind	Clark	Las Vegas	$1 million
62	September 4, 1963	Flash Flood	Clark	Las Vegas	$1 million
62	August 23, 1955	Flash Flood	San Bernardino	Barstow	$1 million

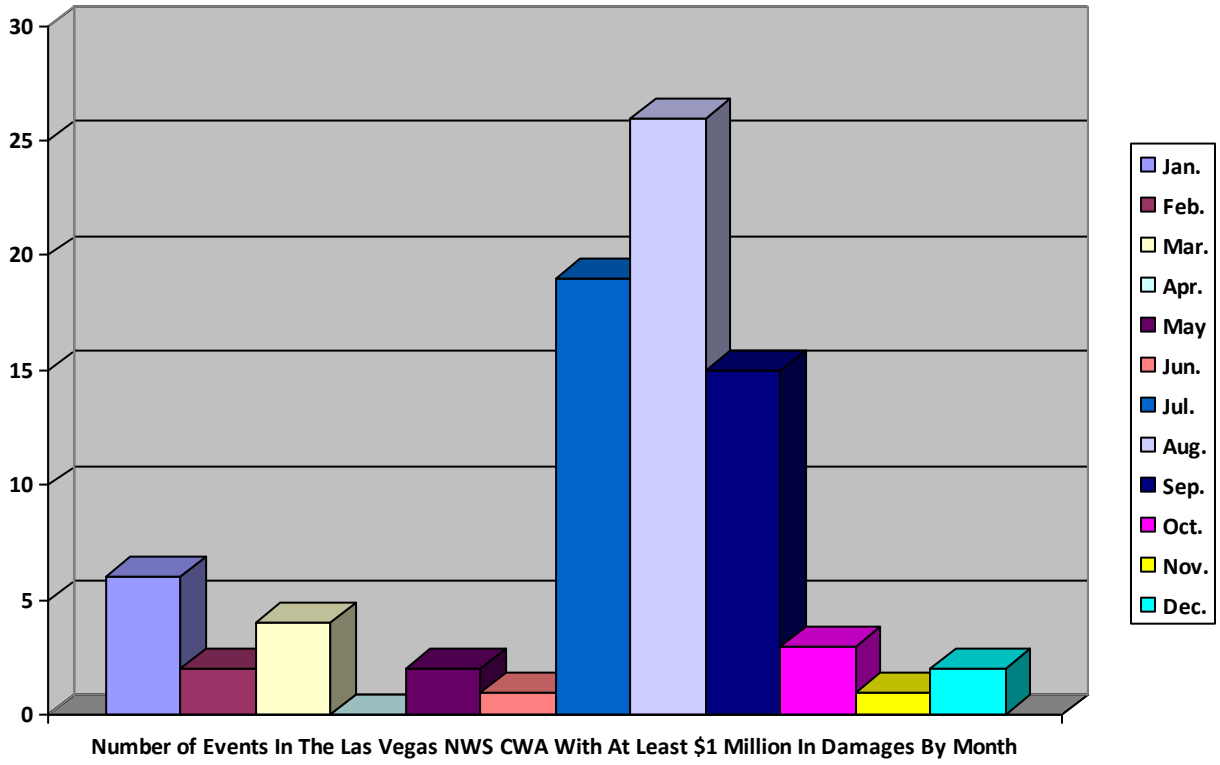
62	August 9, 1947	Flash Flood	San Bernardino	Needles	$1 million

As was the case on the list for events just in the Las Vegas Valley, the Hilton Sign thunderstorm event of July 18, 1994 and the thunderstorm that produced severe hail in Summerlin, northwest Las Vegas and North Las Vegas were the most costly weather event ever in the entire Las Vegas NWS CWA with $50 million in damages. If one adjusts for inflation, the Hilton Sign thunderstorm event would have cost $83.5 million. The New Year's Day Flood of 1910, the oldest known weather disaster in the Las Vegas NWS CWA with at least $1 million in damages, would have caused $46.8 million in 2010 dollars compared to the $2 million dollars it caused back in 1910.



The graph above shows the number of events by the type of weather of the primary cause of damage. The number of events where flash flooding was the dominant cause of damage was 47 and this exceeded the combined total of 37 from the other event types. Thunderstorm winds came in second with 16 events followed by 8 events where flooding was the main cause of

damage. The events of January 21, 2010 in Needles and January 22, 2010 in Wikieup were counted as two separate events here as one is a flash flood event and the other a flood event. Other events in January 2010 between the 18th and 22nd were not counted on this table as the total damages from the type of weather that caused them did not reach at least $1 million. A similar method was also applied to the December 17-23, 2010 "Permalow" event and the September 8, 2014 Norbert remnants where the totals from all river floods and all flash floods were counted as two separate events. In the 'Permalow" event damages from heavy snow, heavy rain and wind not counted due them not reaching at least $1 million in their category. The event of August 27, 2007 was also counted as two events here – one flooding and one lightning – since it had separate entries in *Storm Data* with damage totals of at least $1 million from both flash flooding and lightning. For the damage that resulted from February 23-26, 1969 the event was counted as flooding as damage listed in *Storm Data* and news articles was primarily from flooding.



Number of Events In The Las Vegas NWS CWA With At Least $1 Million In Damages By Month

The graph above shows the number of events by month in the Las Vegas NWS CWA with an event that had damages that totaled at least $1 million. Events were counted as one event on this graph as they were ranked on the list of events. August was the leading month with 26 events, followed by July which had 19 events and September with 15 events. The warm season months by far had the greatest number of events, which correlates well to the number of events that had damages resulting from flash flooding. Although a few of the flash flood events did occur in the cold season, most the result of thunderstorms associated with warm season convection. Only April had no events at all with damages exceeding $1 million. Although the Carpenter 1 Fire extended across 3 months, it was counted just as a July event since it started during this month and was of highest impact during this month.